

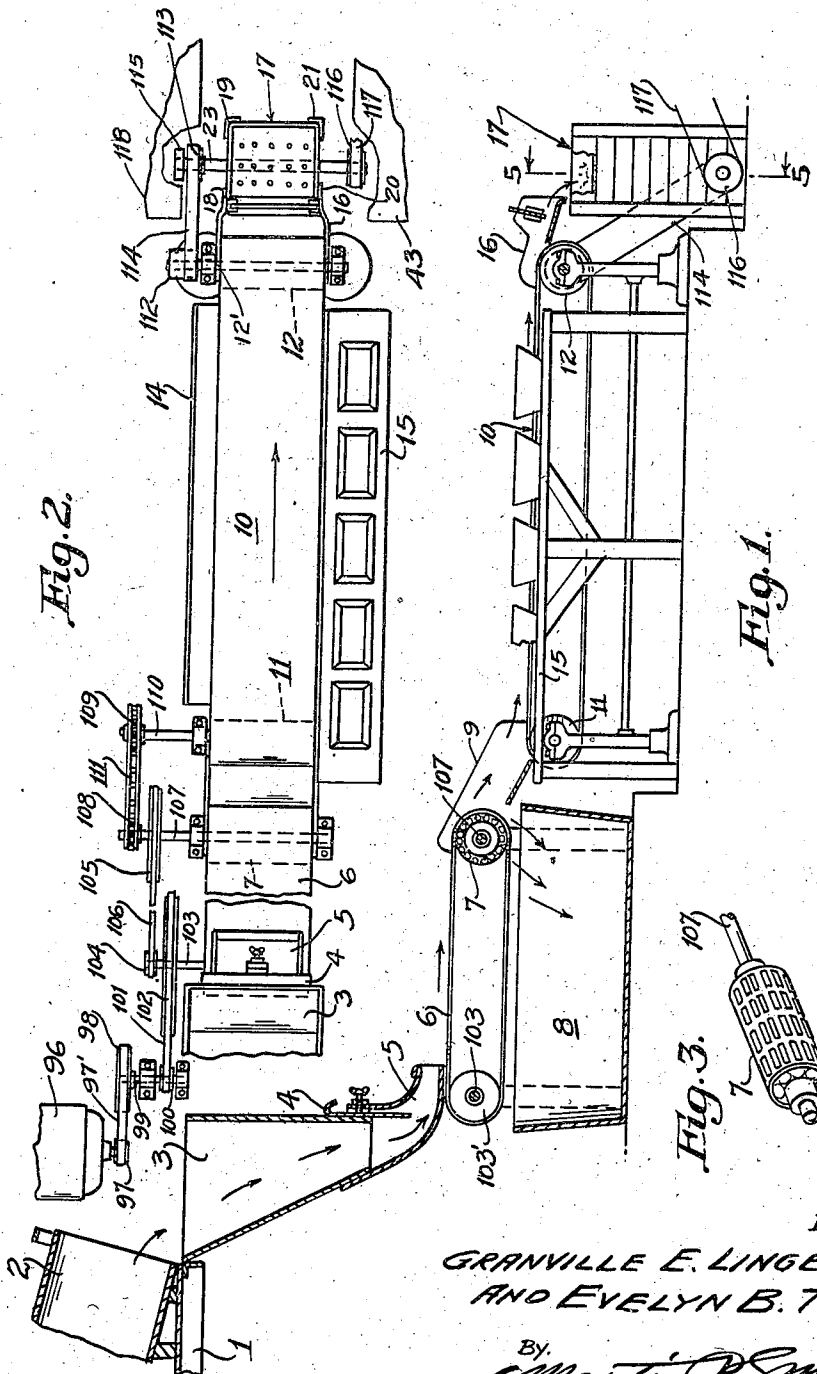
July 25, 1944.

G. E. LINGERFELT ET AL
APPARATUS FOR SORTING RIVETS

2,354,419

Filed March 10, 1941

6 Sheets-Sheet 1



INVENTORS.

GRANVILLE E. LINGERFELT,
AND EVELYN B. TROUT.

By *Martin P. Smith*
ATTORNEY.

July 25, 1944.

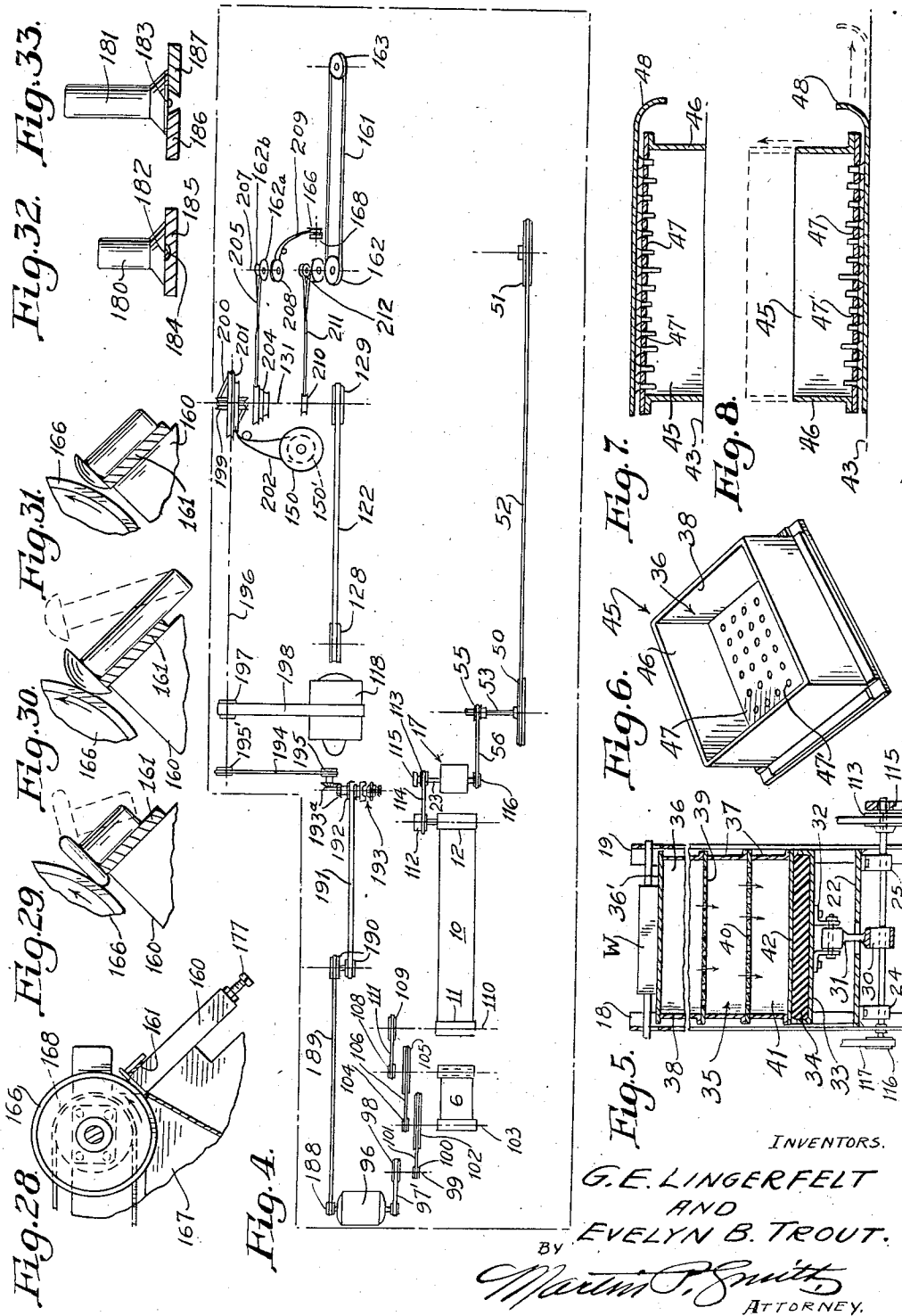
G. E. LINGERFELT ET AL

2,354,419

APPARATUS FOR SORTING RIVETS

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6 Sheets-Sheet 2



INVENTORS.

G. E. LINGERFELT
AND
EVELYN B. TROUT.

By *Martin P. Smith*
ATTORNEY.

July 25, 1944.

G. E. LINGERFELT ET AL
APPARATUS FOR SORTING RIVETS

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6 Sheets-Sheet 3

Fig. 9.

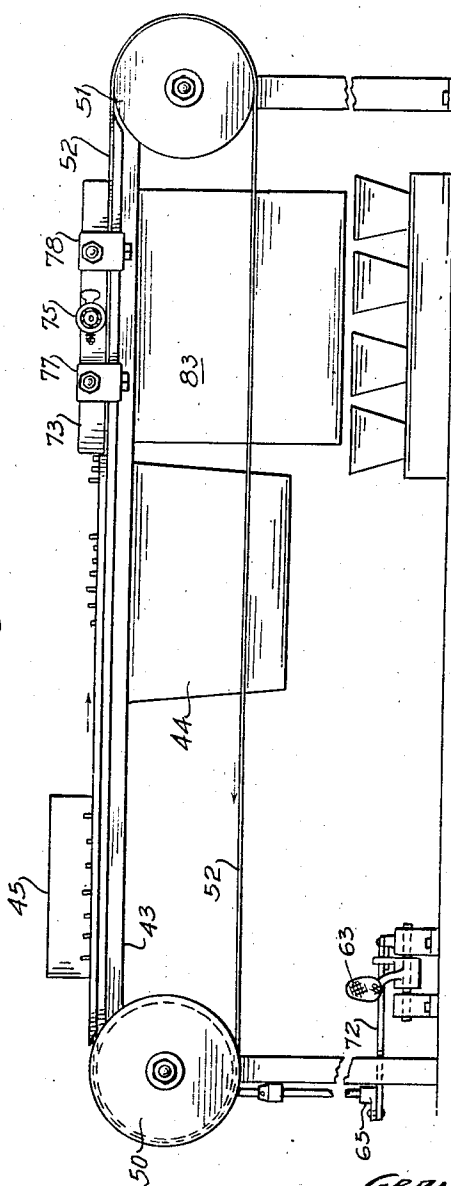


Fig. 17.

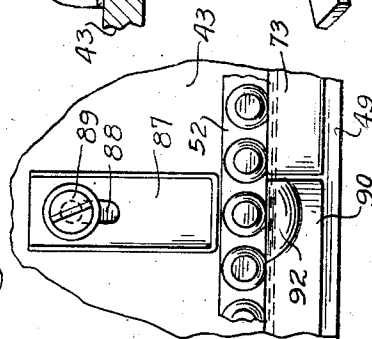


Fig. 16.

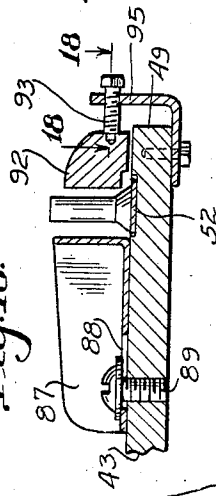


Fig. 18.

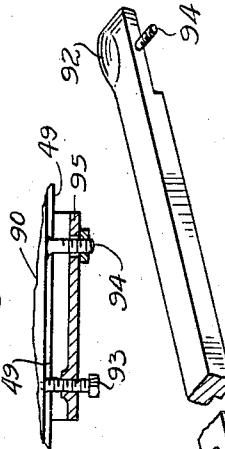
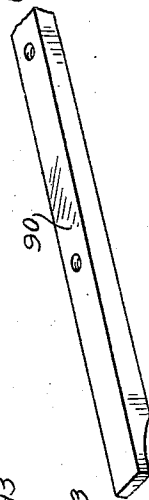


Fig. 19.



INVENTORS.

GRANVILLE E. LINGERFELT
AND
EVELYN B. TROUT.

By
Martin P. Smith
ATTORNEY.

July 25, 1944.

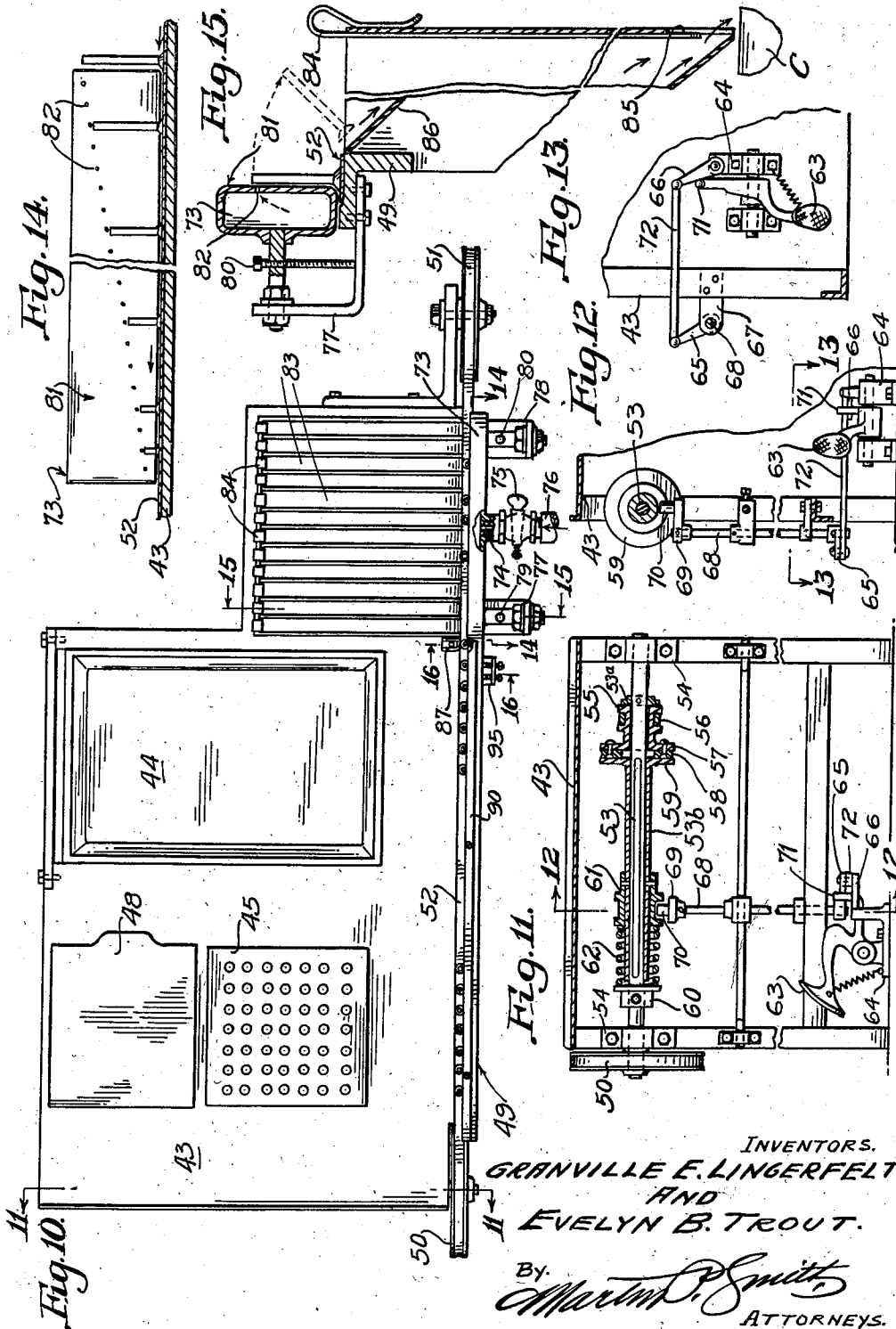
G. E. LINGERFELT ET AL

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6 Sheets-Sheet 4



INVENTORS.
GRANVILLE E. LINGERFELT
AND
EVELYN B. TROUT.

By *Martin D. Smith*
ATTORNEYS.

July 25, 1944.

G. E. LINGERFELT ET AL

2,354,419

APPARATUS FOR SORTING RIVETS

Filed March 10, 1941

6 Sheets-Sheet 5

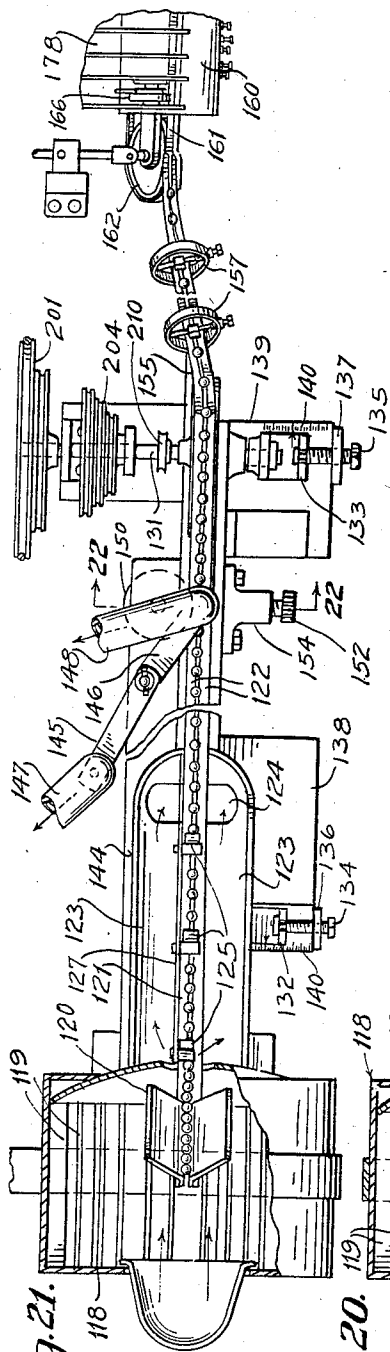


Fig. 21.

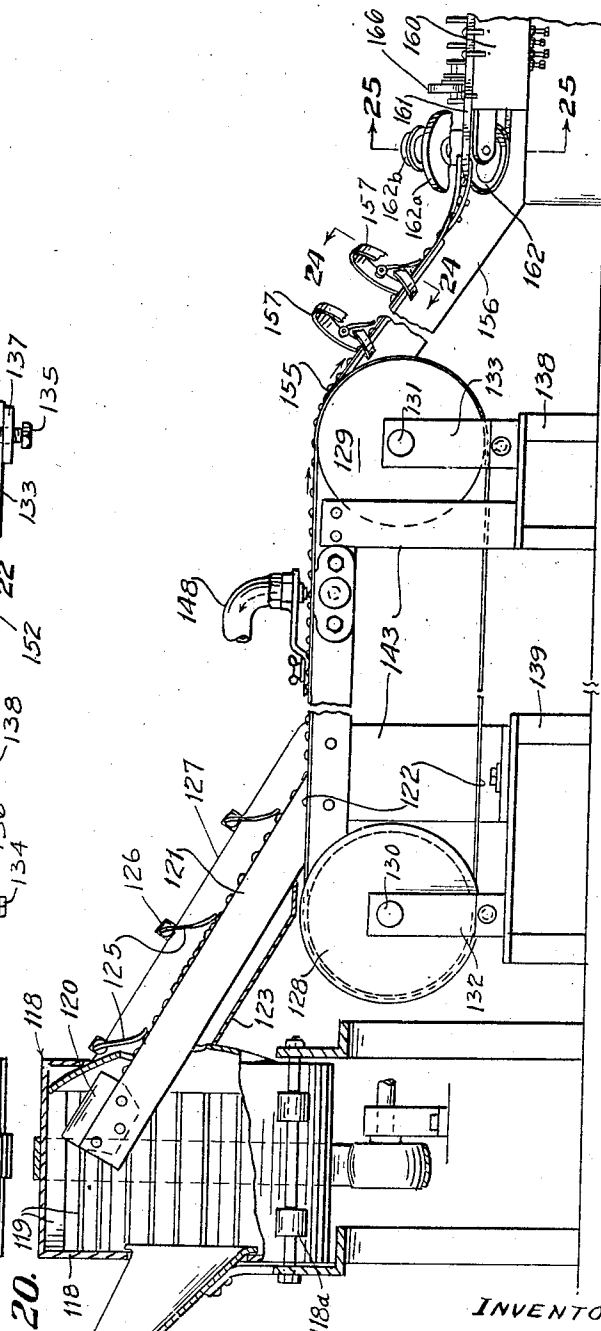


Fig. 20.

INVENTORS.

GRANVILLE E. LINGERFELT
AND EVELYN B. TROUT.

By

Martin P. Smith

ATTORNEY.

July 25, 1944.

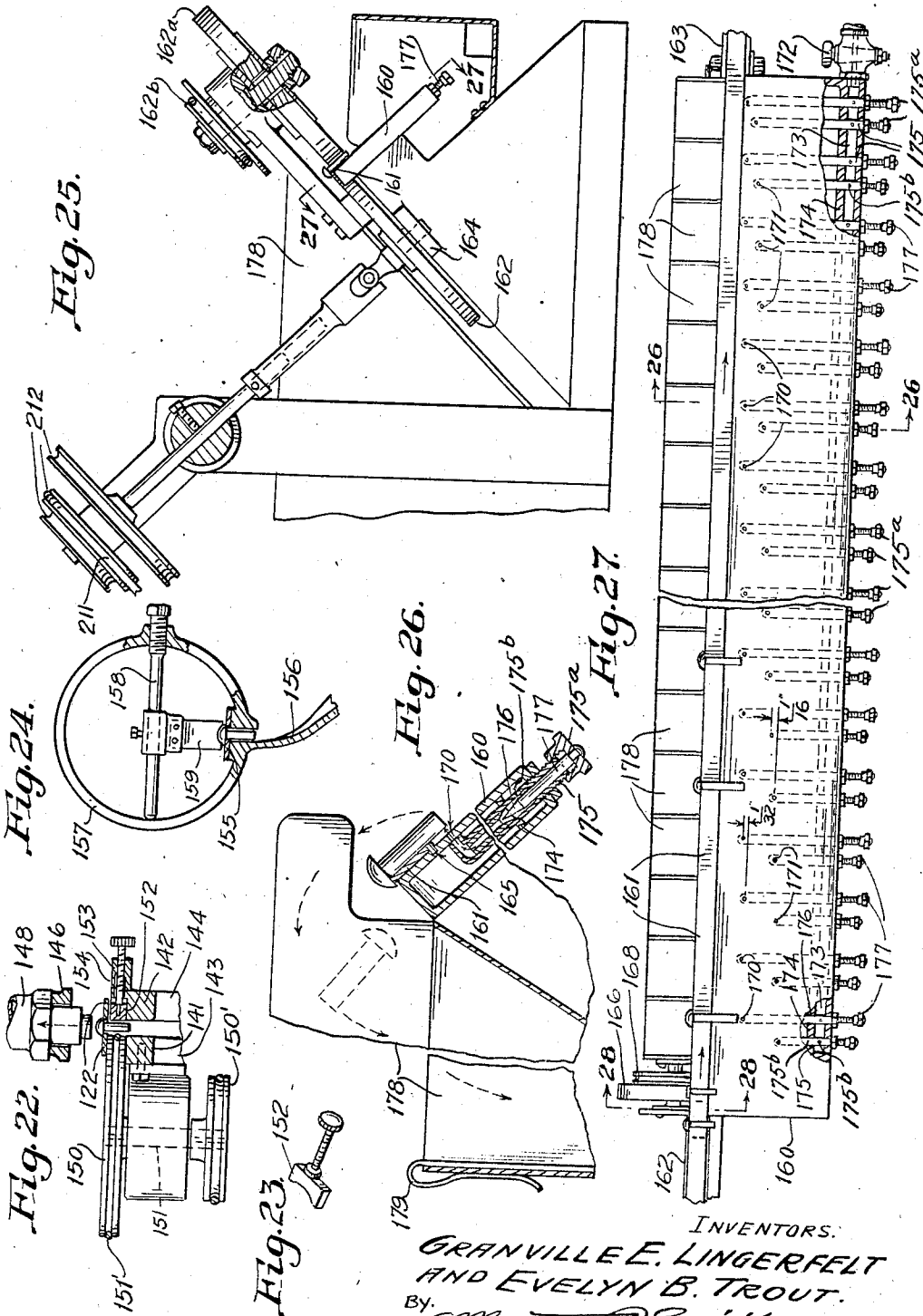
G. E. LINGERFELT ET AL.

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APPARATUS FOR SORTING RIVETS

Filed March 10, 1941

6 Sheets-Sheet 6



INVENTORS.
GRANVILLE E. LINGERFELT
AND EVELYN B. TROUT.
BY *Martin P. Smith*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,354,419

APPARATUS FOR SORTING RIVETS

Granville E. Lingerfelt and Evelyn B. Trout, Los Angeles, Calif.; said Trout assignor to said Lingerfelt

Application March 10, 1941, Serial No. 382,484

6 Claims. (Cl. 209—75)

Our invention relates to apparatus for sorting rivets and more particularly to a system that will receive intermingled bolts, nuts, washers, and other foreign matter in addition to the rivets that are sought to be reclaimed and, through a series of sequential steps or operations, will separate, classify and deliver the rivets to separate receptacles according to the size and shape of the rivet heads and the length and diameter of the shanks or stems.

An important object of our invention is to provide means for sorting both flat and round headed rivets and further, to provide means whereby rivets having the same diameter heads, but different diameter stems, may be segregated.

Another object of our invention is to provide simple and easily operated means for sorting rivets according to the degree of curvature of the heads and the diameters thereof.

One of the principal objects of our invention is, to provide means for reclaiming rivets or the like from intermingled trash which has been swept and recovered from the floors of factories such as aircraft plants or other manufacturing establishments where large numbers of rivets are used.

In many factories and particularly in the large plants now engaged exclusively in the manufacture of aircraft, large numbers of rivets are used in the fabrication of the craft and the workmen engaged in setting the rivets do not retrieve those rivets that drop to the floor, for such practice would during the working periods involve considerable loss of time and consequent production costs, and it is one of the principal objects of our invention to provide a method of and apparatus for reclaiming the dropped rivets for re-use in a practical and economic manner and at a cost considerably less than that of new rivets.

With the foregoing and other objects in view, our invention consists in certain novel features of construction and arrangement of parts that will be hereinafter more fully described and claimed and illustrated in the accompanying drawings in which:

Fig. 1 is a side elevation, partly in section, of the apparatus which receives the floor sweepings and which eventually deposits the sorted parts into a shaker.

Fig. 2 is a plan view of the parts shown in Fig. 1.

Fig. 3 is a detail perspective view of a magnetic roller used in the apparatus.

Fig. 4 is a schematic view of the means for

driving and controlling the various parts of the apparatus.

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 1.

Fig. 6 is a detail perspective of one of the pans used in the shaker.

Fig. 7 is a vertical section taken through the center of the shaker pan and the draw plate used in connection therewith.

Fig. 8 is a sectional view of the shaker pan and draw plate in inverted position.

Fig. 9 is a side elevation of that portion of the apparatus wherein the flat headed rivets are sorted.

Fig. 10 is a plan view of the parts shown in Fig. 9.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10 and showing the drive and control for the feed belt.

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 11 and showing the clutch control.

Fig. 13 is a sectional view taken on the line 13—13 of Fig. 12.

Fig. 14 is a sectional view taken on the line 14—14 of Fig. 10, showing the air manifold and jets.

Fig. 15 is a sectional view taken on the line 15—15 of Fig. 10, showing the air manifold.

Fig. 16 is a sectional view taken on the line 16—16 of Fig. 10, showing the rivet guide.

Fig. 17 is a plan view of the parts shown in Fig. 16.

Fig. 18 is a sectional view taken on the line 18—18 of Fig. 16.

Fig. 19 is a perspective view of the guide bar used to guide the rivets on the belt.

Fig. 20 is a side elevation partly in section of that part of the apparatus used for sorting round headed rivets.

Fig. 21 is a plan view partly in section, of the parts shown in Fig. 20.

Fig. 22 is a sectional view taken on the line 22—22 of Fig. 21, showing means for removing undersized rivets.

Fig. 23 is a perspective view of the adjustable gauge shown in Fig. 22.

Fig. 24 is a sectional view taken on the line 24—24 of Fig. 20, showing the means for retarding and controlling the flow or travel of a row of rivets.

Fig. 25 is a sectional view taken on the line 25—25 of Fig. 20, showing the feed belt and pulley, the drive wheel and air manifold.

Fig. 26 is a sectional view taken on the line

26—26 of Fig. 27, showing the feed belt, air manifold, and part of the receiving bin.

Fig. 27 is a sectional view taken on the line 27—27 of Fig. 25, showing the air manifold and its graduated jet openings.

Fig. 28 is a sectional view taken on the line 28—28 of Fig. 27, showing the wheel for rejecting certain sizes of rivets.

Fig. 29 is an enlarged detail of part of the wheel shown in Fig. 28, showing the rejection of a certain form of rivet.

Fig. 30 is a view similar to Fig. 29, showing the rejection of another form of rivet.

Fig. 31 is another similar view showing a certain form of rivet being carried by the belt past the wheel.

Figs. 32 and 33 show modified forms of feed belts designed for special forms of rivets.

Referring by numerals to the accompanying drawings, 1 designates a platform adapted to support a container 2 that is filled with floor sweepings from an aircraft plant, said sweepings containing lock washers, nuts, bolts, and other small metallic parts, in addition to the rivets sought to be reclaimed. Practically all rivets used in aircraft fabrication are composed of aluminum, or of an alloy thereof and are, therefore, non-magnetizable.

The floor sweepings are dumped into hopper 3 from which they are fed in a measured stream by means of gate 4 and flexible throat 5, onto an endless belt 6. The forward end of belt 6 is carried by a magnetic roller 7 which attracts and holds against the belt all magnetizable parts such as iron washers, steel bolts, and the like, and carries them to the under side of the belt from whence they drop by gravity into a container 8.

The aluminum rivets, being non-magnetizable continue from belt 6, guided by chute 9, onto a sorting belt 10. The belt 10 is carried by rollers 11 and 12 and is provided on one side with a sorting ledge 14, and on the other side with a shelf 15 adapted to support a number of containers for receiving parts other than rivets, said parts being picked out by an operator. The rivets are allowed to move along on belt 10 to a guide chute 16 which deposits them into the top pan of a shaker 17.

The shaker 17 (see Figs. 5, 6, 7 and 8) is supported upon a plurality of upright legs 18, 19, 20 and 21, having a plate 22 fixed adjacent the lower ends thereof, to support a shaft 23, journaled in bearings 24 and 25, carried by the plate 22. Centrally located upon shaft 23 is a strap cam 30 adapted to reciprocate an upright arm 31 which is pivoted to ears 32 carried by shaker plate 33. A series of superimposed sorting pans is located above the shaker plate 33, and between the plate and the lowermost pan is a bumper pad 34.

The sorting pans 35 are of uniform depth except for the top pan 36 which is made deeper than the others since it receives the initial deposit of rivets from the belt 10. The rivets in pan 36 vary as to the size of the heads and it is the purpose of the shaker to sort the rivets and segregate each head size in a separate pan. Pan 36 is provided with a lid 36' and a weight W.

The pans 35 and 36 are provided with upright side walls 37 and 38 and are open at the top. The bottom walls 39 and 40 of the sorting pans are provided with a plurality of uniform apertures (see Fig. 6) and the apertures in the top pan are of a size slightly less than the diameter of the heads of the largest size of rivets being sorted.

The pan below the top pan is provided with

apertures slightly less in diameter than the heads of the rivets of a size next smaller than the largest rivets, and the apertures in the succeeding pans become progressively smaller in diameter to the lowermost pan 41, which receives the smallest size of rivets. This pan has an imperforate bottom wall 42 which is supported by the bumper pad 34.

In the use of our apparatus for sorting rivets, we have found that more efficient results are obtained if the flat headed rivets are sorted separately from the round headed rivets. To this end we provide a table 43, adjacent the shaker, on which we provide an apparatus for sorting the flat headed rivets according to the length of the stems of the rivets, it being understood that rivets having the same size heads may have stems of a variety of lengths and diameters.

The table 43 is provided with a reservoir pan 44 in which are dumped sorted rivets taken from one of the pans of the shaker. These rivets have heads of a uniform size but stems of different lengths and diameters. Adjacent the reservoir 44, we provide a turnover pan 45 (see Figs. 7 and 8) having side walls 46 and a bottom wall 47, provided with a plurality of uniform apertures 47' corresponding to the stem diameter of one size of rivets to be sorted. A draw plate 48 is also adapted to cooperate with the turnover pan 45 in a manner to be hereinafter described.

Table 43 is provided at opposite ends of its front edge 49 with a pair of pulleys 50 and 51, carrying a thin, endless steel belt 52, the upper portion of which passes along the front edge of the table, flush with the upper surface thereof, as in Figs. 10 and 16.

As shown in Fig. 11, the pulley 50 is carried on shaft 53 which is journaled in bearings 54 of table 43. Power is transmitted to shaft 53 by means of a freely mounted pulley 55 driven by belt 56.

A collar 53a is fixed on shaft 53 to limit the movement of pulley 55 in one direction.

Integral with the end of pulley 55 opposite the end that bears against the collar 53a is a flange 57 provided with a clutch face 58 adapted to be engaged by a complementary flange 59 fixed on the end of a sleeve 53b that is loosely mounted on shaft 53, in order to control the rotation of the shaft.

To move the flange 59 into and out of engagement with clutch face 58, we provide a thrust collar 60, fixed to the shaft 53, adjacent the end of sleeve 53b. Fixed on the intermediate portion of sleeve 53b is a grooved collar 61 and interposed between said collar and the thrust collar 60 is an expansive coil spring 62.

To control the clutch on shaft 53, we provide a foot pedal 63 supported by bearings 64. A pair of parallel links 65 and 66 are pivoted to the bearings 64 and the lower end of the vertical shaft 68 which extends upward and carries an arm 69 and pin 70, which latter enters the groove in collar 61.

The foot pedal 63 is provided with a lug 71 adapted to engage a tie rod 72 that is pivotally connected to the parallel links 65 and 66 so that pressure on foot pedal 63 will cause partial rotation of link 65 and shaft 68 to cause pin 70 to shift the collar 61 and sleeve 53b on which said collar is mounted so as to separate flange 59 from the clutch face 58 and thereby stop the rotation of pulleys 50 and 51 and belt 52.

Supported by table 43, parallel to its front edge 49, and slightly overhanging the steel belt 52, as

in Fig. 15, is an air manifold 72 having an inlet port 74. A valve 75 is screwed into the port 74 and is fed by an air hose 76. The air manifold 73 is supported by brackets 77 and 78, fixed to the table, and adjusting screws 79 and 80 are provided to position the manifold at proper clearance with respect to belt 52.

Air manifold 73 is provided upon its inwardly facing surface 81 with a series of small holes or jet openings 82 arranged at progressively greater heights from the surface of belt 52, as shown in Fig. 14. Oppositely disposed to the manifold 73 are a series of parallel bins 83, spaced so that each bin is aligned with a jet 82. Control gates 84 are provided for each of the bins 83, the rear walls of which have discharge openings 85 at the end of the inclined bottoms 86.

As shown in Figs. 10, 16 and 17, a gauge plate 87 is provided adjacent the inner end of the manifold 73, and by means of slot 88 and screw 89 may be adjustably positioned adjacent the inner edge of belt 52. Disposed adjacent the outer edge of the overrunning portion of belt 52 between pulley 50 and manifold 73 is a guide strip 90 which is fixed to the table by screws adjacent its left hand end, the free right hand end thereof terminating opposite gauge plate 87. The free end of guide strip 90 is increased in height as at 92, and said free end is made adjustable with respect to the outer edge of belt 52, by means of an adjusting screw 93 and a limiting screw 94 which pass through bracket 95 (see Fig. 18).

Referring to the means for driving the apparatus thus far described, we have provided as shown in Figs. 2 and 4, a prime mover, preferably an electric motor 96, having a pulley 97 connected by a belt 97' to a speed reducing pulley 98. Pulley 98 is carried by shaft 99 which is also provided with a speed reducing pulley 100 that is connected by belt 101 to a flywheel type of pulley 102. The shaft 103 carries pulley 102 and roller 103' at a slow rate of speed, insuring a slow feed for belt 6. The forward end of belt 6 is carried on magnetic roller 7 which is mounted on shaft 107. Shaft 107 carries pulley 105 which is connected to pulley 104 of shaft 103 by means of belt 106. Shaft 107 also carries sprocket 108 which is connected to sprocket 109 of shaft 110 by means of chain 111. The shaft 110 carries the roller 11 which drives the belt 10 at a slow rate of speed.

The forward end of belt 10 is carried by roller 12, mounted on shaft 12'. The shaft 12' is provided with a wide pulley 112 that is connected to a pulley 113 fixed to shaft 23 of the shaker 17, by belt 114. A loose pulley 115 is also provided on the shaft 23 so that the belt 114 may be shifted thereon by a belt shifter (not shown), for stopping the shaker when the pans are being removed and replaced.

The shaft 23 is provided on its other end with a pulley 116 that is connected by belt 56 to the loose pulley 55 on shaft 53 (see Fig. 11), thus providing a drive for the steel belt 52.

As hereinbefore stated, it is found desirable to sort the flat headed rivets on a separate part of the apparatus as shown in Figs. 4 to 19 inclusive.

Referring to the operation of this part of the apparatus, a reservoir of rivets from one of the pans of shaker 17 is provided by container 44 located on table 43 (see Fig. 10). These rivets have a uniform size of head, but the stems vary as to length and diameter.

The turnover pan 45 is placed on the table 43,

and a quantity of rivets from reservoir 44 are placed thereon. The rivets having the proper stem diameter are worked into the apertures 47' by manipulation and pressure of the operator's hands or with a suitable brush.

The rivets having an undersized stem diameter, being loose in the apertures 47' are readily removed by a manually operated section hose (not shown) or other suitable means.

When the apertures 47' are filled with rivets of the proper stem diameter, the turnover pan 45 is covered with draw plate 48 to secure the heads of the rivets and the two are then overturned into the position shown in Fig. 8. The draw plate 48 is then slid out from under the heads of the rivets and the turnover pan 45 is carefully raised, leaving parallel rows of rivets standing on their heads adjacent the belt 52.

The operator, with a straight edge or the like, now pushes the nearest row of rivets onto the slow moving belt 52, the guide strip 90 serving to keep the rivets in alignment (see Fig. 16) as they move toward the air manifold 73. The free end of guide strip 90 terminates opposite the gauge plate 87 just short of manifold 73. At this point, see Fig. 16, the row of rivets is guided and aligned at the proper distance from the jets 82 of manifold 73.

As shown in Fig. 14, the first jet 82 of the air manifold 73 is the highest from belt 52, and is positioned just below the end of the stem of the longest size of rivets to be stored. A stream of air from jet 82 will strike the rivet (see Fig. 15) and propel it onto the inclined bottom 86 of the bin 83 which is located opposite the jet in use. The rivet will pass through discharge opening 85 into the container C utilized for that particular size of rivet after the gate 84 is opened.

The jets 82 being disposed in an inclined row, are of a sufficient number to accommodate all the different sizes of rivets. The first jet provides a stream of air that will strike the rivets having the longest shanks, the next jet takes care of the rivets having the next longest shanks and so on up to the last jet, which is close enough to the belt to take care of the rivets having the shortest shanks.

The succeeding rows of rivets are sorted in a like manner, until each of the bins 83 is filled with rivets of a uniform head size, stem diameter and length. The different sizes of rivets are then discharged into separate containers and returned to the riveting department for re-use.

The method and apparatus for reclaiming round headed rivets, while presenting special problems, due to the different shapes of the heads, is essentially an integral part of the complete apparatus and embodies the same general principles.

As shown in Figs. 20 and 21, the round headed rivets which have been passed through the apparatus shown in Figs. 1 and 2, are taken from the pans of the shaker 17, where they have been sorted into uniform head sizes, and are poured into a tumbler barrel 118, supported for rotation upon rollers 118a. A series of inwardly extending ribs 119, within the barrel, are adapted to lift the rivets to a point where they will drop into a fixed scoop 120.

The scoop 120 is fixed to the upper end of an inclined, slotted track or guide 121, which terminates adjacent a double, steel belt 122.

The guide 121 is flanked by chutes 123, which catch the excess rivets and permit same to discharge through openings 124 into a suitable con-

tainer from whence they are periodically removed and delivered into barrel 118. A series of flexible rivet retarding and spacing strips 125 are supported by bolts 126 attached to a plate 127 carried by the guide 121.

The double, steel belt 122 is carried by pulleys 128 and 129, which are rotatably mounted upon shafts 130 and 131, journaled in adjustable bearings 132 and 133. Accurate alignment of pulleys 128 and 129 is assured by adjusting screws 134 and 135 which are threaded through nuts 136 and 137 fixed to the base members 138 and 139. Graduations 140 on the base members are used to facilitate accurate adjustment of said pulleys.

As shown in Fig. 22, the steel belt 122 is supported by bars 141 and 142, fixed to base members 143 and 144. Swivelly connected to the base member 144 are arms 145 and 146 carrying suction hoses 147 and 148 for a purpose to be later described.

Between the pulleys 128 and 129 we provide a device that will permit removal of all rivets whose stem diameters are smaller than the size desired to be reclaimed. To this end we provide on one side of the belt 122 a drive wheel 150 (see Fig. 22) having a drive pulley 150' mounted on shaft 151 and a resilient tire 151' to engage a certain type of rivets of uniform size and shape. Oppositely disposed to wheel 150 is a gauge block 152, threaded into the nut portion 153 of a bracket 154, for engaging the rivets from the opposite side.

The next step in the method is to sort the rivets according to shape of the heads and the length of the stems. The rivets, upon reaching the end of belt 122, are fed upon a slotted, inclined, transfer track 155, which is supported by frame member 156.

To retard the flow of the rivets down the transfer track 155, and evenly space the same, we fix to the track, as in Fig. 24, split rings 157, provided with an expanding bolt 158 that threads into one side of the ring 157 and abuts the other side. A flexible strip 159 is centrally carried by bolt 158 and is adapted to yieldingly engage the heads of the rivets.

An air manifold 160, similar in principle to the manifold 73, is supported, as in Figs. 26 and 27, in an inclined position, and a steel belt 161 is arranged to move along the upper part of the face thereof. The belt 161 is carried on pulleys 162 and 163 journaled in frame members 164 (see Fig. 25).

As shown in Figs. 20 and 21, the transfer track 155 is inclined both vertically and laterally so as to overlap pulley 162 and guide the rivets onto the inclined belt 161 so that they will overhang the face of the manifold 160, as in Fig. 26. A pin 165 is fixed to the manifold between the pulleys 162 and 163 to support the belt 161. A feed wheel 162a, driven by pulley 162b, is positioned above pulley 162 to engage the rivets and feed the same upon belt 161 as they leave the track 155.

The rivets that reach the belt 161 are now of the proper head and stem diameter, but some of the rivets may have heads of different head curvature as shown in Figs. 29 and 30. To remove these head types before they reach the manifold 160, we provide a gauge wheel 166 adjustably mounted upon frame 167 as in Fig. 28.

A drive pulley 168 is fixed to wheel 166 to rotate the same. Fig. 31 shows the means utilized for permitting rivets of the same head curvature to be carried along by belt 161, while all others are removed by wheel 166.

The final step in the method is to sort the rivets according to the length of the stems.

In aircraft work or the like, one series of rivets may differ in length by $\frac{1}{2}$ of an inch while another series may differ by $\frac{1}{4}$ of an inch. In order to handle more than one series of rivets, we provide through the wall forming the face of the manifold 160 (see Fig. 27) a pair of inclined rows of jet openings 170 and 171. The openings 170 vary in distance from belt 161, by $\frac{1}{2}$ of an inch so as to engage the rivets that differ from each other by that distance. The openings 171 vary in distance from belt 161 by $\frac{1}{4}$ of an inch so as to engage the rivets that differ from each other by that distance.

The manifold 160 is provided with air, at one end by a valve 172, the air flowing through a passage 173 defined by a wall 174.

Seated in the lower end wall of the air manifold 160 are the outer ends of tubes 175 that extend through air chamber 173, through wall 174, and the upper ends of these tubes communicate respectively with the individual jet openings 170 and 171.

The ends of the tubes 175 that project outwardly from the lower end wall of the housing 160 are threaded for the reception of nuts 175a, which nuts carry needle valves 177, the pointed ends 176 of which are adapted to engage corresponding seats formed within the tubes 175 and thereby control the flow of compressed air through said tubes and the jet openings 170 and 171.

Formed through the lower portions of the tubes 175 and communicating with the air passage 173 are air inlet apertures 175b. These apertures are located to the rear of the seats for the pointed ends of the needle valves 177 (see Figs. 26 and 27).

A series of compartments or bins 178, similar to bins 83 are provided co-extensive with the manifold so that each bin is aligned to receive rivets from a pair of jets 170 and 171. Gates 179 are arranged to control the discharge of rivets from the bins.

Modified forms of rivet carrying belts are shown in Figs. 32 and 33. Special forms of rivets 180 and 181 are formed with centrally disposed projecting tits or nubs 182 and 183 and to permit these rivets to rest upon the belts head down, it is necessary to provide a groove 184 in belt 185. A similar result is obtained by using two belts 186 and 187 in parallel relation to accommodate the nubs 183.

The apparatus for sorting round headed rivets is provided with motive power from the motor 96 by means of a pulley 188 (see Fig. 4), connected by belt 189 to idler pulleys 190. Pulley 190 is connected by belt 191 to pulley 192 and a clutch 193 is interposed to control the drive. The pulley 192 is connected by bevel gears 193a to pulley 195, which is connected by belt 194 to pulley 195' on shaft 196. A pulley 197 on shaft 196 drives the tumbler barrel 118 by means of belt 198. The shaft 196 also carries a pulley 199 which is connected by belt 200 to a double, change speed pulley 201 on shaft 131. Pulley 201 is also connected by belt 202 to a pulley 150' for imparting motion to the drive wheel 150.

The shaft 131 is also provided with a triple pulley 204 connected by a half-crossed belt 205 to a pulley 162b on shaft 207. Pulley 162b is used to drive wheel 162a as in Fig. 25. Also located on shaft 207 is pulley 208 which by means of belt 209, drives pulley 168 on gauge wheel 166. The pulley 129 is carried by shaft 131 which also carries pulley 210, connected by belt 211 to pulley 212 for driving pulley 162.

Referring to the operation of the apparatus for sorting round headed rivets, it will be noted in

Figs. 20 and 21, that round headed rivets taken from one of the pans of the shaker 17 may be inserted into the tumbler barrel 118 through the open end. The inwardly extending ribs 119 of the barrel lifts the rivets and drops some of them into the scoop 120, from which they gravitate down the slotted, inclined track to the double belt 122 where they are carried along, suspended by their heads.

The rivets at this point are uniform as to head diameter but varied as to head curvature, stem diameter and stem length. To sort out rivets of undersized stem diameter, the wheel 150 and gauge block 152 are utilized to permit passage of the certain sized rivets, while the others are lifted from the belt by suction hose 148. The hose 147 may be used by an operator to pick out foreign matter or parts from the belt as they leave the guide 121.

The rivets move along beyond belt 122, over transfer track 155 and onto belt 161 where they are fed by wheel 162a to a point in front of gauge wheel 166 where rivets of different head sizes or curvature are removed from the belt. The rivets are now of proper size except as to the length of the stems.

As the rivets move along the belt 161, the ends of the stems are progressively engaged by air jets continuously issuing from the graduated air jet openings 170 or 171. The rivets are "kicked" or propelled upwardly and rearwardly as illustrated by dotted lines, Fig. 26, into classified bins 178 from whence they may be discharged into suitable containers.

Vacuum or air suction hose similar to the hoses 147 and 148 may be provided above and adjacent the sorting belt 10 and the table 43, which hose may be conveniently manipulated by the operators standing adjacent the tables 15 and 43, thus enabling the separation of defective rivets from those rivets that pass inspection, and likewise providing for the ready removal of rivets composed of different alloys and which have different degrees of hardness. It is the practice of rivet manufacturers to apply to such rivets identifying marks to indicate the different alloys or degrees of hardness and which marks generally take the form of minute indentations or "dimples" or minute studs or projections on the centers of the rivet heads.

Further, the operator or operators working at table 43 may readily inspect all rivets that are lined up on the table and with a straight edge moved onto belt 52, and while this work is being done the operator may readily note and remove any rivets having bent or defective shanks or stems, thus adding materially to the effectiveness of the sorting and classification of the rivets.

From the foregoing it is evident that we have provided apparatus for separating rivets from sweepings containing waste products and elements or parts of ferrous metal, sorting the flat and round headed rivets into a number of classifications as to diameter and curvature of the heads and diameter and length of the stems, and also separating the rivets composed of different aluminum alloys and which have different degrees of hardness. This work is done in a simple, practical and efficient manner which enables us to receive the floor sweepings from the factory, sort out trash and miscellaneous parts and return the classified rivets to the factory at a cost substantially less than that of new rivets.

The apparatus herein shown is merely illustrative and numerous minor changes may be

made without departing from the spirit of the invention or the scope of the appended claims.

We claim as our invention:

1. In an apparatus for sorting and classifying rivets and the like, the combination with a table, an endless carrier operating along one side of said table and adapted to receive and carry rivets, an air manifold arranged adjacent the discharge end of said carrier and said manifold being provided in its side wall adjacent the over running portion of said belt with a row of jet openings for directing jets of air against the stems of the rivets carried by said carrier to expel said rivets from said carrier and the individual openings forming said row being located at different distances from the rivet carrier, of rotary means for engaging at least, the heads of some of the rivets and removing the rivets having such heads from the endless carrier.

2. The combination as set forth in claim 1 and with receptacles for receiving the rivets projected from said carrier by said jets of air.

3. In an apparatus for sorting and classifying rivets and the like, an endless carrier comprising a pair of spaced parallel members, means for delivering rivets onto the over-running portion of said carrier, with the rivets resting upon the spaced members and the stems of the rivets passing between said members, an inclined endless carrier for receiving the rivets from said first mentioned carrier, rotary means for engaging at least the heads of some of the rivets and removing the rivets having such heads from said carrier, an air manifold supporting the over-running portion of said inclined carrier, the wall of said manifold adjacent the supported portion of the carrier being provided with a series of jet openings disposed at different distances from the supported portion of the carrier and valvular means for controlling the flow of air through said jet openings.

4. An apparatus for sorting and classifying rivets and the like as set forth in claim 3 and with air suction means for removing rivets from the carrier comprising the spaced parallel endless members.

5. In an apparatus for sorting rivets, the combination of means providing two surfaces arranged at approximately right angles to each other, an endless belt having a reach traversing one of the surfaces adjacent the line of intersection of said surfaces, said belt being adapted to have rivets deposited thereon with the shanks lying adjacent the belt and the heads projecting over the edge of the belt and over the other of said surfaces, and a rotary gauge wheel mounted for rotation adjacent said edge of the belt for engaging the heads of some of the rivets and removing them from the belt.

6. In a rivet sorting apparatus, the combination with means operative to receive and carry rivets in a row along a definite path of travel with the rivet heads uppermost, of rotary means located adjacent said rivet receiving and carrying means and operating on an axis parallel with the path of travel of the row of rivets for engaging at least some of the heads of the rivets and removing the rivets having such heads from the carrying means and means located beyond said rotary means in the direction of travel of the rivets, for directing air jets against the shanks of the rivets which pass the rotary means and remove said rivets from the carrying means.

GRANVILLE E. LINGERFELT.
EVELYN B. TROUT.